
काँच रेशा प्रबलित जिप्सम पैनल — विशिष्टि

**Glass Fibre Reinforced Gypsum
Panels — Specification**

ICS 91.100.10

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Limes and Gypsum Products Sectional Committee had been approved by the Civil Engineering Division Council.

Glass fibre reinforced gypsum (GFRG) is a building panel product, made essentially of gypsum plaster, reinforced with glass fibres.

GFRG panels can be manufactured from various types of gypsum, such as natural gypsum, flue gas desulphurization gypsum, phospho-gypsum and chemical gypsum. The use of phospho-gypsum, an industrial waste obtained from the fertilizer industry, is particularly beneficial from the perspective of sustainability being the utilization of waste.

Use of GFRG panels as walls and floor slabs in buildings, with the cavities filled with concrete or appropriate inert material, contribute significantly to sustainability, owing to the resulting savings in the use of high energy-intensive and scarce materials such as cement, steel, sand and water.

The success of the system depends on the quality of the panels produced in the factory and its handling. This standard has been formulated based on the research and field experience, to provide guidance in production and supply of quality GFRG Panels. A separate standard, IS 17401 : 2021 'Design and construction of buildings using glass fibre reinforced gypsum panels — Code of practice', has also been formulated on the design and construction of GFRG buildings.

In the formulation of this standard, the research and development work done by the Indian Institute of Technology Madras, Chennai and the work done by Building Material and Technology Promotion Council, Ministry of Housing and Urban affairs, Government of India, have been utilized.

The composition of the Committee responsible for the formulation of this standard is given in Annex H.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GLASS FIBRE REINFORCED GYPSUM PANELS — SPECIFICATION

1 SCOPE

This standard specifies constituent materials, dimensions and physical requirements, test methods, packaging and transportation requirements of glass fibre reinforced gypsum (GFRG) building panels, for building construction.

2 REFERENCES

The standards listed below contain provision, which through reference in this text, constitute provision of this standard. At the time of publication, the edition indicated were valid. All the standards are subject to revision and parties to agreement based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
456 : 2000	Plain and reinforced concrete — Code of practice (<i>fourth revision</i>)
2469 : 1976	Glossary of terms relating to gypsum (<i>first revision</i>)
2542 (Part 1/Sec 2) : 1978	Methods of test for gypsum plaster, concrete and products Plaster and concrete, Section 2 Normal consistency of gypsum concrete
(Part 1/Sec 5) : 1978	Plaster and concrete, Section 5 Compressive strength and dry set density of gypsum plaster
(Part 1/Sec 12) : 1978	Plaster and concrete, Section 12 Dry bulk density
3346 : 1980	Method for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot – plate method) (<i>first revision</i>)
4905 : 2015	Random sampling and randomization procedures (<i>first revision</i>)
11320 : 1997	Glass fibre rovings for the reinforcement of polyester and of epoxide resin systems

IS No.

Title

12654 : 1989	Low grade gypsum-use in building industry — Code of practice
13630 (Part 13) : 2019	Ceramic tiles — Methods of test sampling and basis for acceptance: Part 13 Determination of scratch hardness of surface according to mohs' scale (<i>second revision</i>)
IS/ISO 834 (Part 4) : 1999	Fire resistance tests — Elements of building construction: Part 4 Specific requirements for load bearing vertical separating elements

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2469 and the following shall apply.

3.1 External flange – The two outer faces collectively making up the GFRG panel (*see* Fig. 1).

3.2 Internal Rib – The inner portion connecting the two external flanges of the panel (*see* Fig. 1).

3.3 Cavity – The The internal hollow cores inside the GFRG panel (*see* Fig. 1).

3.4 Nominal Panel Length – The centre to centre horizontal dimension of end ribs of a single wall without vertical joint (*see* Fig. 1).

3.5 Overall Panel Length – The maximum horizontal dimension of a single wall without vertical joint. (*see* Fig. 1).

3.6 Panel Height – The maximum vertical dimension of a single wall without a horizontal joint.

3.7 Panel Thickness – The distance between the external faces of the two external flanges (*see* Fig. 1).

4 CLASSIFICATION

GFRG panels shall be supplied in following classes:

- Class 1* : To be used for load-bearing structural elements, like, walls and slabs/roofs.
- Class 2* : To be used for non load-bearing elements, like, internal partition/boundary walls.

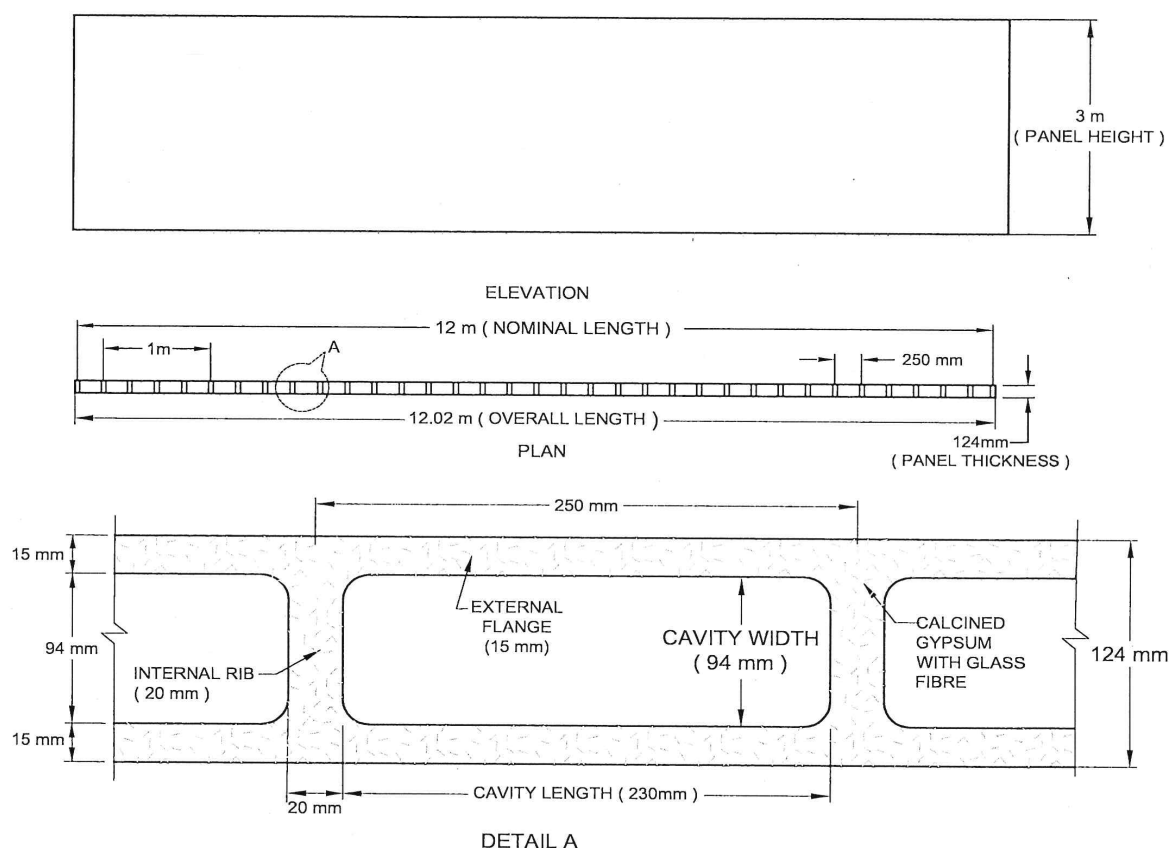


FIG. 1 CROSS-SECTION OF GFRG PANEL

5 RAW MATERIALS

5.1 Calcined Gypsum/Gypsum Plaster

The calcined gypsum/gypsum plaster shall be produced as given in IS 12654. Suitable retarder may be used as per IS 12654. The calcined gypsum/gypsum plaster shall have properties as given in Table 1.

Table 1 Requirements of Calcined Gypsum
(Clause 5.1)

SI No.	Properties	Requirement	Test Method
(1)	(2)	(3)	(4)
i)	Free moisture, percent, <i>Max</i>	0.1	Annex A
ii)	Combined water, percent, <i>Max</i>	6.2	Annex A
iii)	<i>pH</i> , <i>Min</i>	4.5	Using <i>pH</i> meter
iv)	Normal consistency, ml/100g, <i>Max</i>	66	IS 2542 (Part 1/Sec 2)
v)	Bulk Density, kg/m ³	850 – 1 100	IS 2542 (Part 1/Sec 12)
vi)	Compressive strength, MPa, <i>Min</i>	4.5	IS 2542 (Part 1/Sec 5)

5.2 Glass Fibre Rovings

Glass fibre rovings used shall be E Glass rovings with a diameter of $13 \pm 2 \mu\text{m}$, tensile breaking load of 470 N, *Min* and Tex 2400 to 3800 g/km, when tested in accordance with IS 11320.

5.3 Potable Water

The water used in the production of panels shall conform to the requirements specified in IS 456.

6 MANUFACTURING PROCESS

6.1 To the calcined gypsum/gypsum plaster produced as per IS 12654, other suitable performance improvers may be added for specific requirements without affecting other quality parameters.

6.2 The panel shall be manufactured on a specially designed table of suitable size. The manufacturing of the GFRG panel shall be done in three stages. In the first stage, the 15 mm bottom layer shall be formed by pouring the calcined gypsum, followed by even spreading of glass fibres of suitable length by means of screeding and rolling processes. In the second stage, special aluminium plugs, of dimensions 230 mm × 94 mm, as given in Fig. 2, shall be put over the finished first

layer in such a manner that 20 mm gap is available between two adjacent plugs to form the cavities. The 20 mm gaps between the plugs are filled with the calcined gypsum and glass fibres. In the third stage, the process of the first stage shall be repeated to complete the top layer of the panel. After setting (not before 25 min), the plugs shall be withdrawn, the table shall be rotated in its vertical position, and the panel shall be taken out by means of a special fork lift for drying. The drying of the panel shall be done in a drying chamber, in which hot air is circulated to dry the panel evenly for minimum 90 min.

6.3 The GFRG panels are generally manufactured in 12 m × 3 m nominal size. Other sizes may be manufactured as agreed between the manufacturer and purchaser, subject to alteration only in the overall length of the panel, like, 6 m × 3 m, 3 m × 3 m, etc. and both the ends shall be closed with ribs of 20 mm thickness. All dimensions and shape requirement for the other sizes remain the same except the length. Each 1.0 m segment of the panel shall contain four 'cells'. Each cell shall be of 250 mm length and 124 mm thickness, containing a cavity of size 230 mm × 94 mm. The various cells shall be interconnected by solid 'ribs' (20 mm thick) and flanges (15 mm thick).

7 PHYSICAL REQUIREMENTS

7.1 General

The two external faces of all panels shall be sound and free from defects like cracks, corrugation, ripples, pockmarks, stains, loose corners, cracks or any other defects, which would adversely affect a painted decorative surface finish.

NOTE — One face of the panel which is in contact with the table is smoother than the other face.

7.2 Visual Inspection, Dimension and Tolerance

7.2.1 Visual Inspection

Every finished panel shall be visually inspected to ascertain absence of defects such as cracks, exposed glass fibres on both surfaces, dents and damages.

7.2.2 The dimensions and tolerances of the GFRG panel, when tested as per Annex B, shall be as given in Table 2.

7.2.3 Tolerance on shape

- a) *Tolerance on straightness of edge* – The tolerance on the straightness of the edge shall be 3 mm per meter.

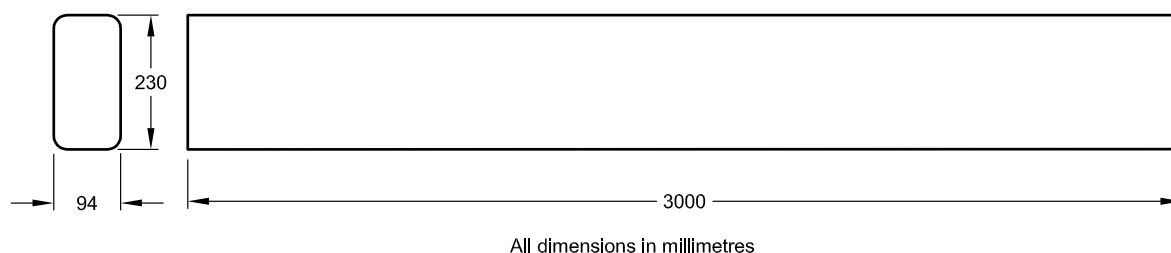


FIG. 2 SIDE VIEW AND LONGITUDINAL SECTION OF ALUMINIUM PLUG USED FOR MANUFACTURE

Table 2 Dimensional Requirements of GFRG Panels
(Clause 7.2.2)

Sl No.	Item	Dimension mm	Tolerance mm
(1)	(2)	(3)	(4)
i)	Overall Length	12 020	± 3
ii)	Height	3 000	± 3
iii)	Thickness	124	± 3 to 0
iv)	External Flange Thickness	15	± 2 for Class 1 ± 5 for Class 2
v)	Internal Rib Thickness	20	± 3 for Class 1 ± 5 for Class 2
vi)	Cavity width	94	± 4 for Class 1 ± 7 for Class 2
vii)	Cavity length	230	± 3 for Class 1 ± 7 for Class 2

NOTE — The above tolerances are applicable for other sizes of the panel, if manufactured as agreed between the manufacturer and purchaser.

- b) *Tolerance on squareness of edge* – The tolerance on squareness of the edge shall be 4 mm per meter.

7.3 The GFRG panels shall comply with the properties as per Table 3.

Table 3 Requirements of GFRG Panels
(Clause 7.3)

SI No.	Property	Value	Test Method
(1)	(2)	(3)	(4)
i)	Water content, percent, <i>Max</i>	1.0	Annex C
ii)	Panel mass, kg/m ² , <i>Min</i>	44 ± 6 percent	
iii)	Water absorption, percent by mass, <i>Max</i>		Annex D
	a) After 1 h	1.0	
	b) After 24 h	5.0	
iv)	Vertical Load bearing capacity, kN/m, <i>Min</i>		Annex E
	a) Class 1	160	
	b) Class 2	90	
v)	Out-of-plane moment capacity, Rib parallel to span (M_{uc}), kNm/m, <i>Min</i>		Annex F
	a) Class 1	2.1	
	b) Class 2	1.3	
vi)	Out-of-plane moment capacity, Rib perpendicular to span (M_{perp}), kNm/m, <i>Min</i>		Annex F
	a) Class 1	0.88	
	b) Class 2	NA	
vii)	Moh's hardness, <i>Min</i>	1.6	IS 13630 (Part 13)
viii)	Fire resistance (structural adequacy/integrity/insulation), minutes, <i>Min</i>	120/120/120	IS/ISO 834 (Part 4)
ix)	Glass Fibre content, <i>Min</i>	64.8 g/m ² ± 5 percent	Annex G

8 SAMPLING

8.1 Lot

In any consignment, all the panels of same size and class manufactured in a day using same mix design, ingredient materials, under same manufacturing conditions and dryer condition shall be grouped together to constitute a lot.

The number of panels to be selected at random from the lot shall be in accordance with Table 4.

The panel shall be selected from a lot at random in order to ensure the randomness of selection. The procedures given in IS 4905 may be followed.

Table 4 Number of Samples per Batch
(Clause 8)

Lot size	Sample Size for Dimensional Requirements	Acceptance Number	Sample Size for other tests
(1)	(2)	(3)	(4)
Up to 500	5	0	2
501 to 1 000	8	0	3
1 001 to 3 000	13	1	5
3 001 and above	20	1	8

8.1.1 Each panel selected in accordance with col 1 and col 2 of Table 4 shall be subjected to the tests for the dimensional requirements. Any panel failing to meet one or more of the requirements shall be considered as 'defective'. If the number of panels found defective is less than the corresponding acceptance number given in col 3 of Table 4, the lot shall be considered as conforming to the dimensional requirements.

8.1.2 The lot which has been found as conforming to the dimensional requirements shall then be subjected to tests for water content, water absorption, vertical load-bearing capacity, out of plane bending capacity, glass fibre quantity and fire resistance. For this purpose, the number of panels to be selected shall be in accordance with col 5 of Table 4. The lot shall be considered as conforming to these requirements if no defective is found.

8.1.3 The lot shall be considered as conforming to the requirements of the standard if requirements of 7 are satisfied.

9 GUIDELINES FOR CUTTING, HANDLING, STORAGE AND DELIVERY

These provisions (9.1 to 9.4 and 9.4.1) are good practices which should be followed for good results.

9.1 Cutting

Cutting shall be made with specific machine; impact tools such as hammer shall not be used for cutting or removing part of the panel. All cutting shall be made in accordance with the drawings and requirements provided by the client. Generally the following requirements are applicable:

- Tolerance (in terms of length and height of panel) is ± 2 mm;
- Openings is partially cut in the factory, leaving about 100 mm at the corner to be cut after installation of the panel;
- Damage to corners is limited to within 10 mm × 10 mm (shall be rectified before delivery); and

- d) Damages to end and sides during internal handling is limited to within ± 10 mm (to be rectified).

9.2 Handling

Handling of panel shall be made with specific machinery or with specially designed jaws. Movement of panel shall be reasonably slow and care shall be taken to prevent undue sagging, cracking or damage to the panel especially at the sides, edges and corners. The customer should take care of handling of the panels at site.

9.3 Stacking

GFRG panels shall be neatly stacked to avoid panel distortion, damage or moisture ingress. This may be achieved by stacking vertically on support extending the full length of the panel or a firm, clean and flat surface not susceptible to moisture. It shall also be kept free of any dirt, oil or other foreign matter. Whenever a panel is vertically positioned temporarily, a wooden block of size 250 mm $\times$ 250 mm $\times$ 250 mm shall be placed underneath the ribs.

When vertically stacked in open air, panels shall be protected from collapse caused by strong wind. A good practice is stacking panels inside a stillage with its stabilizer legs extended.

9.3.1 Protection from Weather

All panels shall be kept dry preferably by being stored inside a building and under cover. Where it is necessary to store the panels outside, it shall be stacked properly and covered.

9.4 Delivery

GFRG panels shall be packed and loaded on specifically designed stillage or stuffed properly and delivered by suitable trucks with proper covering/supports. Extreme care shall be taken in loading, transportation and unloading to ensure the safety and protection of the panels from damage due to collision or collapse of the panels. Care shall be exercised to avoid exceeding the maximum allowable height of vehicles applicable to a specific road in a specific area.

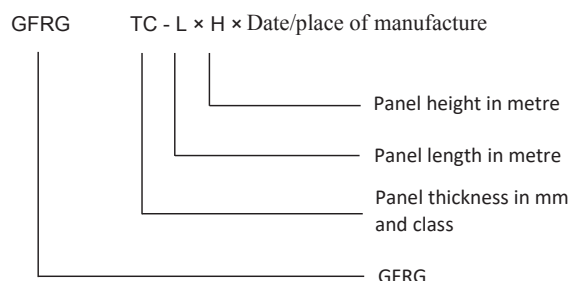
9.4.1 Acceptable Damage

Improper handling of panels in the factory or at the construction site can cause damage of the flange and

ribs (in some cases), in which case, the permissible damage is limited to 1 m $\times$ 1 m area. This damage should be rectified only after the panel is erected on the plinth beam.

10 PRODUCT CODING

GFRG panels are coded using the following convention:-



For example, a GFRG panel of Class 1 made at Kochi on 20th January 2020 shall be coded as:

GFRG 124C1-12 $\times$ 3 $\times$ 20 Jan 2020/KOCHI

11 MARKING

11.1 Each manufactured GFRG panel shall be clearly marked with the following particulars:

- Product code in accordance with **10**;
- Name of the manufacturer and registered trade-mark, if any, with address;
- Brand name, if available;
- Batch number;
- Quality checked mark and identification of the checker; and
- Signs for packaging and transportation.

11.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(Table 1)

FREE MOISTURE AND COMBINED WATER TEST OF CALCINED GYPSUM**A-1 PURPOSE OF THE TEST**

The purpose of the test is to measure the free moisture and combined water content of calcined gypsum/gypsum plaster.

A-2 SAMPLING

Samples to be tested shall be collected and stored in a sealed container. If organic matter is present in the sample, it may decompose and render the test inaccurate.

A-3 APPARATUS**A-3.1 Heat Moisture Balance with Metal Pans**

The heat moisture balance used for free moisture and combined water test shall have the following specifications:

- a) Capacity – 50 g
- b) Least count – 0.005 g
- c) Metal pans – 100 mm diameter disposable aluminium moisture pans; new pans shall be used for each test
- d) Lamp for heating – 400 Watt halogen lamp
- e) Drying temperature – 50 to 200 °C
- f) Calibration – Use sodium tartrate dihydrate (contains 15.6 percent of chemically uniform moisture).

A-3.2 Ensure that the instructions have been read before operation, and that the machine is calibrated to specifications.

Preheat the moisture balance for about 8 minutes at a temperature of 160 °C. Put 5 g of Sodium Tartrate Dihydrate in the metal pan. A moisture content rate of 15.5-16.0 percent (0.1 percent or lesser adheres to the surface) shall be obtained.

A-4 TEST PROCEDURE

- a) Switch on the balance. Place aluminium pan on pan holder;
- b) Place 10 g of the sample and distribute evenly over the pan. A minimum sample weight of 10 g is to be used (preferably);

c) For free water, adjust the lamp height and voltage to the free water test setting, enabling a temperature of 45 °C to 50 °C to the pan.

d) Turn the lamp on.

e) Record the percentage loss in mass after constant mass has been achieved. When the percentage weight loss per minute reaches 0.00 for 2 min, this represents constant weight.

f) This is the free moisture reading and shall be recorded.

g) For combined water, adjust the lamp height and voltage to the combined water test setting, enabling a temperature of 175 °C to 180 °C to the pan.

h) Record the percentage loss of weight after constant weight has been achieved. When the percentage loss per min reaches 0.00 for 2 min, this represents constant mass.

j) This is the combined water reading and shall be recorded.

Note — If the percentage loss per minute reading has not reached 0.00 after 45 min, then the sample shall be retested for another 45 min, and percentage value of the combined water will be needed to be added to the previous combined water value.

A-5 CALCULATION

Calculations are avoided by operating the balance to read percentage weight loss directly, or if the weight loss readings are in grams then multiplication by a factor of 10 gives the percentage. The free water result is on a wet basis, and the combined water on a dry basis.

A-6 REPORT

Report percentage free moisture and percentage combined water.

A-7 PRECAUTION

Care shall be taken to ensure that the balance is dry and clean. All weighing shall be carried out carefully to avoid any error.

ANNEX B(*Clauses 7.2.2*)**TEST METHODS FOR DIMENSIONS****B-1 MEASUREMENT OF DIMENSIONS**

B-1.1 The overall and cross-sectional dimensions shall be measured from the selected test panel.

B-1.2 Apparatus

The tools used for measurements shall have an accuracy of 0.1 mm.

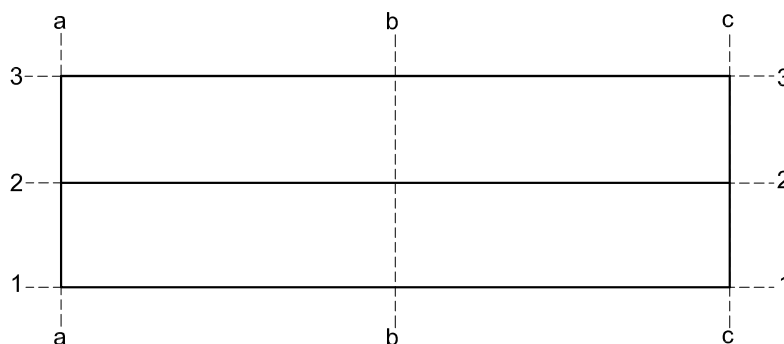
B-1.3 Measurement

The length of the panel shall be measured at three location (along grid 1-1, 2-2 and 3-3) as shown in Fig. 3.

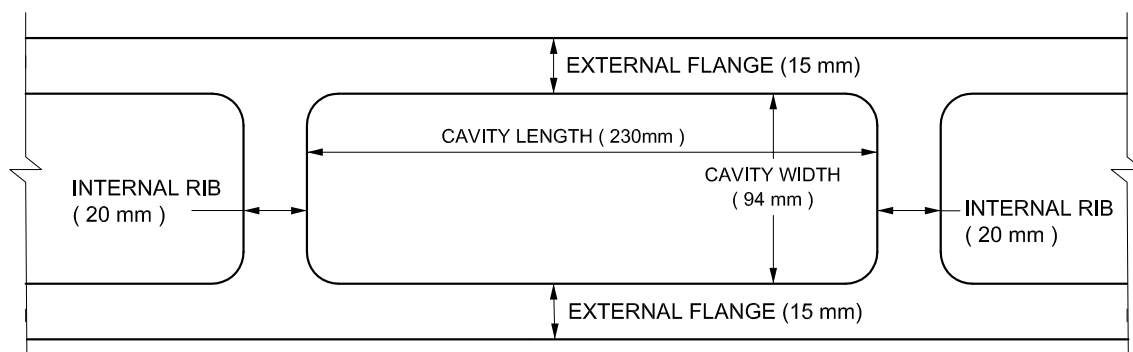
The height of the panel shall be measured at three locations (along grid a-a, b-b and c-c) as shown in Fig. 3.

The thickness of the panel shall be measured at nine locations (at the point of intersection of grids 1-1, 2-2, 3-3 and grids a-a, b-b, c-c as shown in Fig. 3).

The dimensions of external flange, internal rib, cavity length and cavity width in the panel shall be measured at six locations (grid 1-a, 1-b, 1-c, 3-a, 3-b and 3-c) as shown in Fig. 3.



3A POSITIONS OF OVERALL DIMENSION MEASUREMENTS



3B CROSS-SECTIONAL MEASUREMENT POINT

FIG. 3 DIMENSIONAL MEASUREMENTS

ANNEX C

(Table 3)

MEASUREMENT OF WATER CONTENT

C-1 GENERAL

This test measures the loss of moisture of the specimen after drying in a standard oven. The water content shall be tested on specimen of size 250 mm (length) × 300 mm (height) of the selected panel.

C-2 APPARATUS

- a) *Air circulating oven* – The oven shall have sufficient free space inside to accommodate the specimens. The oven shall have a temperature control at 40 ± 2 °C and a humidity control at 50 ± 2 percent.
- b) *Weighing balance* – The balance shall have a capacity of 5 kg with an accuracy of 0.5 g.

C-3 TEST PROCEDURE

C-3.1 Weigh each original specimen and record their mass;

C-3.2 Condition the specimen (or specimens) to constant weights, within 0.1 percent of the dried weight, at a temperature of 40 ± 2 °C, in an atmosphere having a relative humidity of 50 ± 2 percent. This may be done by drying the specimen for 24 h initially and weighing the specimen; then drying for another 4 h each time and weighing the specimen until the difference of the two consecutive weights of the specimen is within 0.1 percent of the dried weight;

C-3.3 Weigh the dried mass of each specimen to within 0.5 g.

C-4 CALCULATION OF RESULTS

The weight loss of the individual specimen in percent with respect to its dried weight is the water content of the specimen.

ANNEX D

(Table 3)

MEASUREMENT OF WATER ABSORPTION RATE

D-1 APPARATUS

- a) *Water bath* – The bath shall have enough room to immerse the three specimens and keep them separated and elevated from the bottom of the bath with minimum spaces of 25 mm.
- b) *Weighing balance* – The balance shall have an accuracy of 0.5 g.

D-2 TEST PROCEDURE

D-2.1 Immerse the specimens of size 250 mm (length) × 300 mm (height) flat in water at a constant temperature

of 27 ± 2 °C with a head of 25 mm of water over the top of the sample. The sample should be positioned in the water bath elevated 25 mm above its base.

D-2.2 Remove the specimens from the bath after 24 h of immersion, wipe excess water from the surfaces and edges of the specimens and weigh immediately to within 0.5 g.

D-3 CALCULATION OF RESULT

The percentage of weight gain with respect to the dried weight of each specimen calculated is the water absorption rate.

ANNEX E

(Table 3)

MEASUREMENT OF VERTICAL LOAD-BEARING CAPACITY**E-1 GENERAL**

The test specimen shall have a size of 520 mm (length) × 250 mm (height).

E-2 APPARATUS**E-2.1 Universal Compression Machine**

The test machine shall be calibrated once in a year using a standard load cell.

E-3 TEST PROCEDURE**E-3.1 Measurement of Dimension**

The width of the test specimen shall be measured at the waist of the specimen. The measurement shall be taken on both the front face and the back face of the specimen and an average value shall be used.

E-3.2 Placing of Specimen

The test specimen shall be placed at the centre of the platen on the test machine. Under no circumstance

should any part of the specimen be placed outside the perimeter of the platen of the test machine.

E-3.3 Capping

The top and bottom faces of the test specimen shall be capped with a thin layer of quick-setting plaster to ensure firm and uniform contact and parallelism between both platens. The strength of the applied plaster shall not be lower than that of the test specimen at the time of testing.

E-3.4 Loading

Apply the compression load gradually in a rate not greater than 10 kN per minute, until it reaches the peak load and then drops at least 20 percent off the peak load. The maximum applied load (peak load), F indicated by the testing machine shall be recorded.

E-4 CALCULATION OF RESULTS

The unit strength of a specimen is reported as $p = F/B$, in a unit of kN/m, where F is the peak load in kN, and B is the width at the waist of the specimen, in m.

ANNEX F

(Table 3)

FLEXURAL STRENGTH TEST**F-1 SAMPLES**

The test specimens shall have a size of 1 200 mm length and 1 020 mm width. The specimen shall be cut at least one meter away from the side of the panel parallel to height.

F-2 APPARATUS**F-2.1 Bending Testing Machine**

The test machine shall be calibrated once in a year using a standard load cell.

As the specimen is 1 020 mm wide, it is important for the load and reaction force from the supports is distributed evenly along the width of the specimen. The point load from a load jack is applied to a main distribution beam which then distributes the load equally to two secondary distribution beams. The load is finally transferred from the secondary distribution beams to the top face of the test specimen as evenly distributed line loads.

To ensure good contact and even distribution of load, a thin layer of quick-setting plaster shall be applied between the bottom face of the secondary beams and the contact surface of the specimen.

The specimen shall be supported firmly with one pin support and one roller support as illustrated in Fig. 4. The pin support shall be composed of two steel plates, 1 020 mm long × 100 mm wide × minimum 10 mm thick, and a 1 020 mm long steel roller bar with a minimum diameter of 30 mm welded to the bottom of plate. The top plate just sits on top of the bar to ensure free rotation. The roller support shown in Fig. 4 shall be similar to the pin support except that some smaller steel roller bars of about 10 mm diameter and 1 020 mm length shall be provided underneath the bottom steel plate to ensure both free rotation and longitudinal movement.

F-3 TEST PROCEDURE

- For Class 1 panels, out-of-plane bending tests are to be conducted both for ribs of the panels kept parallel to the span, and those kept perpendicular to the span. For Class 2 panels, only panels with ribs kept parallel to the span need to be tested.
- Mark the positions of support line (centre line position of the roller bar) on the bottom of the specimen, and load line (centre line position of the secondary distribution beam) on the top of the test specimen.
- Set up the pin and roller supports.
- Apply a thin layer of quick-setting plaster on the top of the supporting steel plates and then place the test specimen on top of the two supports. Wait a few minutes for the plaster to set.
- Apply a layer of quick-setting plaster on the top of the test specimen at the position of the secondary distribution beams and place the secondary distribution beams in position. Allow the plaster to set.
- Set up the rest of the loading system (main distribution beam and its support, etc.) and loading jack as shown on Fig. 4.

- Load the jack under load control at a rate not greater than 10 kN per minute, until the load passes the peak and drops at least 50 percent off its peak load.

F-4 CALCULATION OF RESULTS

The maximum moment capacity, M_u (kNm/m), of a specimen is given by

$$M_u = 1/8 wL^2 + 1/6 (F + S) \times L$$

where

w = Unit weight of the panel, in kN/m;

F = First peak load, in kN;

S = Weight of the load distribution system including the main and secondary distribution beams, in kN; and

L = Span which is 1.2 m.

The first peak load is the applied load at which the first major crack occurs (usually accompanied with a clear sound of breaking).

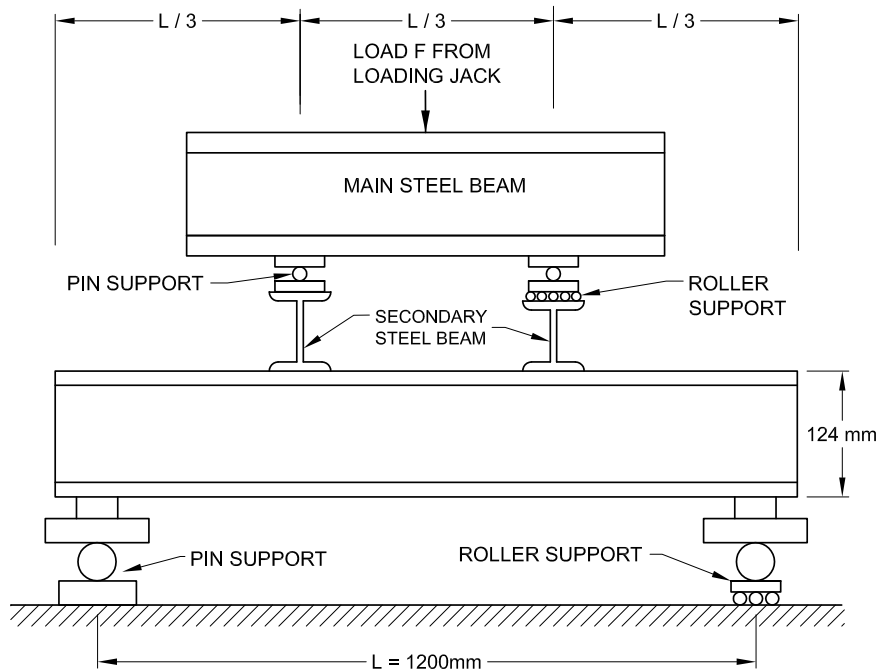


FIG. 4 FLEXURAL TEST SET UP

ANNEX G*(Table 3)***GLASS FIBRE QUANTITY CHECK****G-1 PROCEDURE**

For test purpose, cut a panel of size 270 mm long and 300 mm wide (incorporating 1 cavity and 2 ribs). Crush this to separate out glass fibres from the flanges and

ribs. Once separated, wash the glass fibres carefully in clean water to remove any gypsum contamination and note the weight after drying the glass fibres at 50 °C. The total weight of fibres shall be 64.8 g $\pm$ 5 percent.

ANNEX H

(Foreword)

COMMITTEE COMPOSITION

Building Limes and Gypsum Products Sectional Committee, CED 4

<i>Organization</i>	<i>Representative(s)</i>
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